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September 21, 2006

Ms. Pamela C. Creedon
Executive Officer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive No. 200
Rancho Cordova, Ca. 95670

Subject: Comments re Draft Waste Discharge Requirements for UCD Center for Aquatic Biology and Aquaculture (NPDES No. CA 0083348)

Dear Executive Officer:

I appreciate the opportunity to submit these comments on the draft renewal of the NPDES permit for the UCD Center for Aquatic Biology and Aquaculture ("CABA") (NPDES NO. CA 0083348).

General Comments:

I am providing comments regarding the new requirement to commence groundwater monitoring for ponds associated with the CABA facilities. The draft permit imposes extensive groundwater monitoring requirements which are unreasonable and unnecessary to assure the protection of waters of the state.

UCD actively monitors groundwater in the area in support of groundwater remediation projects, and has data for the past 20+ years. From a review of the area's hydrogeology, groundwater quality, and existing groundwater monitoring data sets, it is evident that the quality of effluent discharged into ponds (and Putah Creek) from the CABA facilities equals or exceeds the quality of groundwater in the area that could be potentially impacted by any releases from ponds receiving CABA effluent.

The Monitoring and Reporting Program for this permit specifically requires monitoring of pH, COD (chemical oxygden demand), total nitrogen, EC (electrical conductivity), oxytetracycline, formaldehyde, and standard minerals. The specific comments that follow provide an analysis of the hydrogeology at the facility, the general water quality in the receiving groundwater based on historic reports and recent groundwater monitoring data, and a comparison to measured and calculated effluent water quality data.

Specific Comments:

1. **Hydrogeology:** The facility is located on the low alluvial plains associated with the Putah Creek alluvial fan (Scott and Scalmanini, 1975; DWR 2003). The near-surface sediments belong to the distal portions of alluvial fan deposits associated with Putah Creek. The sediments in the general vicinity of the site are primarily composed of silts and clays with inclusions of sands and gravel from buried former stream channels of Putah Creek. The surficial sediments of the young alluvium (0' to approximately 180' depth) are primarily of late Pleistocene to recent age and include recent stream channel and flood plain deposits. Underlying these shallow deposits are older alluvial sediments of Quaternary age and continental deposits belonging to the Tehama Formation of Tertiary and Quaternary age.

A generalized cross-section obtained from monitoring well records at a facility adjacent to the Aquatic Center indicates that the upper fifty feet of sediments are composed of very shallow (less than 10 feet) and localized sand and gravel of a former stream channel, and silty sand. At depths of approximately 10' to 25', the logs show laterally extensive clay. Laterally extensive clay with relatively thin clayey sand lenses is also found at depths exceeding 40 feet (Figure 3 in Dames and Moore, 1990). Depth to first encountered groundwater in this area typically ranges from 30' near Putah Creek to over 50' in areas not in the vicinity of Putah Creek. Groundwater flow is generally west to east although locally the groundwater flow direction may vary. In the vicinity of Putah Creek, groundwater flow diverges from the Creek due to recharge of surface water in Putah Creek. Existing monitoring well networks nearby the CABA facilities indicate a north-easterly groundwater flow in the area immediately north of Putah Creek.

2. **Historic Water Quality of the Receiving Groundwater:** The historic background water quality in the vicinity of this site has been established in a report by Scalmanini (1978) who described water quality between 1971 and 1976 in domestic and agricultural wells used on the UC Davis campus. Agricultural wells are completed in the upper aquifer units to depths ranging from 250' to over 500'. Water quality in these wells is generally representative of groundwater in the uppermost 300' – 500'. Between 1971 and 1976, the average annual EC in these upper groundwaters varied from 1.09 - 1.23 mmhos / cm, the average TDS (total dissolved solids) varied from 654 - 788 mg/l, the average Cl (chloride) varied from 32 - 39 mg/l, and the average NO_3 varied from 22 - 28 mg/l. Water quality in the upper aquifer is known to be significantly influenced by agricultural activities, particularly fertilizer use (DWR, 2003). These data reflect the overall historic background water quality across the campus facilities surrounding the CABA sites, because water quality samples are taken from high-yielding agricultural production wells screened in the upper portions of the aquifer.

3. **Background Water Quality, Putah Creek Facility:** Data from groundwater monitoring performed in accordance with Waste Discharge Requirement R5-2003-0077 issued by the California Regional Water Quality Control Board-Central Valley Region was reviewed. Specifically, monitoring wells #7A and #16-A, which are both near the Putah Creek Facility, were selected to establish a range of background water quality because of their proximity to the facility and because these wells are monitored for pollutants addressed in the Waste Discharge Requirement cited above. Over the past two years, EC, TDS, Cl, and NO_3 concentrations in these wells were in the ranges 1.0 - 1.1 mmhos/cm, 530 - 730 mg/l, 14 – 25 mg/l, and 37 – 80 mg/l, respectively.

4. **Background Water Quality, Aquatic Center:** Additionally, the Environmental Protection Agency requires groundwater monitoring at a National Priorities List (NPL) site that lies adjacent to Putah Creek appximately 2.5 miles downstream of the Aquatic Center facility. Groundwater quality has been monitored at this location for over 20 years. Two background wells, UCD1-001 and UCD1-018 are similarly situated near Putah Creek and represent shallow groundwater in the area that has not been impacted by contaminanats from the NPL site. Groundwater monitoring at these wells was performed in accordance with Administrative Order on Consent for Removal Action and Remedial Investigation/Feasibility Study (University of California Operable Unit) issued to the University of California by the United States Environmental Protection Agency, US EPA Docket # 99-16. During the period 1990 – 2004, average EC, and average NO_3 concentrations in these wells ranged from 0.8 – 1.1 mmhos/cm and from 42 – 53 mg/l. The average Cl concentration during that period is 26 mg/l.

5. **CABA Facilities Discharges**: Water quality of the CABA facilities discharge primarily reflects the water quality in the source water (well water, Lake Berryessa water). Well water EC is in the range of 0.6 – 0.9 mmhos/cm. Lake Berryessa water EC ranges from 0.2 – 0.5 mmhos / cm. Well water serves as the main source, while Lake Berryessa water serves as a supplement source. EC concentrations in the effluent of the the CABA facilities is in the range of 0.6 – 0.8 mmhos/cm (2003 – 2006 monthly data, Brent Cutler, Dept. Environmental Health and Safety, University of California Davis, *personal communications*). There is no statistical difference in EC levels between the source water and the effluent water. At this level, EC is significantly lower than in the receiving shallow groundwater. Because the TDS is directly linked to EC, the same relative difference exists between the TDS in the facilities discharge and the TDS of the receiving groundwater. Chloride concentrations in the effluent are reported to be 28 mg/l, approximately the same as in the source water. Per Finding 28 of the draft WDR, during sodium chloride treatments, the estimated maximum concentration of sodium chloride in the effluent is 30 mg/l, which is equivalent of 18 mg/l of chloride. Hence, even during treatment, chloride concentrations are not significantly elevated in the facilities discharge relative to that in the receiving groundwater and are well below water quality standards. Nitrogen concentrations in the facilities discharge are currently not known. But a calculated concentration of the nitrogen added in the facility to the nitrate-nitrogen that is in the source water (groundwater, Lake Berryessa irrigation water) can be obtained by performing a simple nitrogen budget for the facility: The

optimal feeding rate for fish is on the order of 2% of the bodyweight per day. The crude protein content of the feed is approximately 40% by weight (Dr. Silas S. O. Hung, Dept. of Animal Science, University of California, Davis; *personal communication*). By weight, one-sixteenth of the protein is nitrogen. Conservatively assuming that all fish in the facility were adult fish with near-negligible weight gain, the nitrogen in the feed is equal to the nitrogen excreted into the discharge. The facilities stock at most 12,000 lbs of fish and the daily discharge rate is an average of 1.36 mgd (Findings 7 and 8). At an optimal feeding rate, the resulting added total nitrogen concentration is (12,000 [lbs] x 0.02 [1/d) * 0.4 / 16) / 1.36 mgd = 0.5 [mg/l]. Practical feeding rates may exceed optimal feeding rates by 100% resulting in an added total nitrogen concentration of 1 mg N/l (equivalent to 4.5 mg/l NO_3). Even without accounting for denitrification during soil percolation, these added levels of nitrogen are insignificant relative to the existing nitrate concentrations in shallow groundwater and are unlikely to be detected by a groundwater monitoring system.

6. **Risk of Formaldehyde Transport to Groundwater**. Formalin is administered as an external parasite treatment. It is typically administered upon positive diagnosis of external parasites or prophylatically when new fish are brought into the facilities. When necessary, five treatments are given 24-48 hours apart over a 5-10 day period. Over the past years, the sequence of five treatments have been administered 3 – 6 times per year. The frequency of application is not expected to significantly change (Paul Lutes, CABA, *personal communication*). During treatment, the maximum calculated concentration of 0.0334 mg/l formaldehyde is almost two orders of magnitude below the USEPA Drinking Water Health Advisory level of 1.0 mg/l formaldehyde (see draft WDR Finding 26). Note that the maximum calculated concentration was computed as a worst-case scenario of a one-time event. Furthermore, scientific literature indicates significant attenuation of formaldehyde during passage through the unsaturated zone: Formaldehyde is a relatively unstable organic compound that rapidly degrades through photooxidation and biodegradation. Estimated half-lives in soils are 1 – 7 days and in groundwater 2 – 14 days (Howard et al., 1991). Finally, even background environmental concentrations of formaldehyde in rain, snow, and fog have been reported to be in the range of less than 0.001 mg/l to over 1 mg/l (Chenier, 2003), at or above the levels in the facilities effluent. Given the intermittent administration of formalin at the low levels described above, there is no significant risk of groundwater degradation or of exceedance of the 1 mg/l USEPA Drinking Water Health Advisory level in groundwater due to discharge of CABA facilities effluent.

7. **Risk of Oxytetracycline Transport to Groundwater**. Application of oxytetracycline occurs only when a positive diagnosis of a bacterial infection is made. It is generally not used as a prophylactic. Application is a 14 day treatment. Over the past years, treatments have occurred from 2 – 4 times per year and similar application frequencies are expected in the future (Paul Lutes, CABA, *personal communication*). During treatment, the maximum calculated concentration of 0.2 mg/l oxytetracycline is one order of magnitude below the USEPA Drinking Water Health Advisory level of 1.0 mg/l formaldehyde and the 96-hour NOAEL of 40.4 mg/ oxytetracycline (see draft WDR Findings 26 and 27). Again, the maximum calculated concentration was computed as a worst-case scenario during a one-time event. Furthermore, scientific literature indicates significant attenuation of Oxytetracyline in soil and groundwater downgradient from wastewater storage lagoons associated with animal farming (Campagnolo et al., 2002; Hamscher et al., 2002). All of the monitoring wells in these studies were located in extremely shallow groundwater (water collected from depths of ten to thirty feet) of relatively coarse-textured, sandy aquifers. Lagoon concentrations of tetracyclines (including oxytetracycline) were on the order of a 0.01 to 0.4 mg/l. Unlike at the CABA facilities, these were permanently elevated concentrations in the waste discharge water stored in these lagoons. Even under those permanent source conditions, oxytetracycline concentrations were generally below the detection limit. In one study, one of the monitoring wells showed a concentration of 0.001 mg/l (Campagnolo et al., 2002). At the second study-site all samples showed oxytetracycline below the detection limit of 0.0001 mg/l (Hamscher et al., 2002). Laboratory sorption studies also show sorption of oxytetracyline to soil organic matter (McKay and Canterbury, 2005). Given the intermittent administration of oxytetracycline, the extensive occurrence of clay measured in drilling logs near the CABA facilities, and given the significant depth to groundwater, it is highly unlikely to find measurable levels of oxytetracycline (above 0.0001 mg/l) in groundwater at the CABA facilities.

8. **References**:

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h. McKay, A. A. and B. Canterbury, 2005. Oxytetracycline sorption to organic matter by metal-bridging. J. Environ. Qual. 34, pp. 1964-1971.
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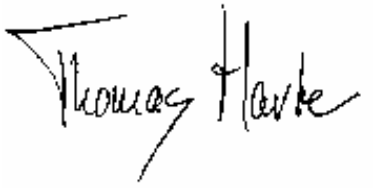
It is evident that the quality of effluent from CABA meets or exceeds the water quality of the receiving groundwater in the area that underlies ponds receiving CABA effluent. Our findings further indicate that there is no risk of groundwater degradation from formaldehyde or oxytetracycline at this site. For all of the reasons described above, the groundwater monitoring provisions contained in the draft permit are not necessary to protect the quality of ground water in the region. The Board should delete the groundwater monitoring requirements proposed in the permit.

Sincerely,



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